Integrating geology in reality mesh ?

François ROBIDA

BRGM (French Geological Survey)

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THE FRENCH GEOLOGICAL SURVEY

THE BRGM IS FRANCE'S LEADING PUBLIC INSTITUTION WORKING IN EARTH SCIENCE APPLICATIONS FOR THE MANAGEMENT OF SURFACE AND SUBSURFACE RESOURCES AND RISKS.

ITS ACTIVITIES ARE GEARED TO SCIENTIFIC RESEARCH, SUPPORT TO PUBLIC POLICY DEVELOPMENT AND INTERNATIONAL COOPERATION.

UNDERSTANDING
geological phenomena and associated risks.

DEVELOPING
new methodologies and techniques.

PRODUCING
and disseminating data to support the management of soils, subsoils and their resources.

DELIVERING
the necessary tools for managing soils, subsoils and their resources, preventing risks and pollution and developing climate change policies.

Over
1000 staff
including more than 700 engineers and researchers

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OUR INFRASTRUCTURES AND CITIES ARE NOT LAYING ON A FLYING CARPET

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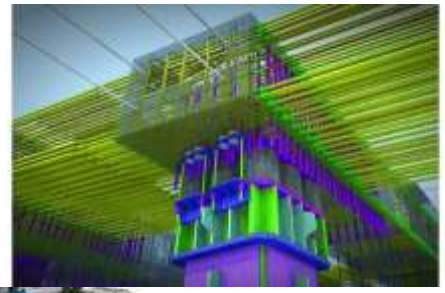

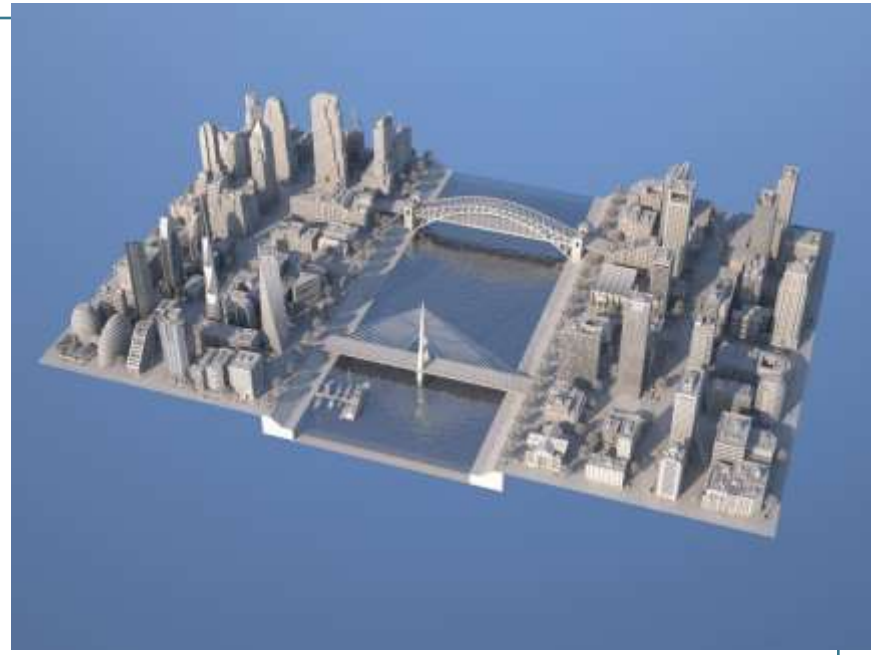

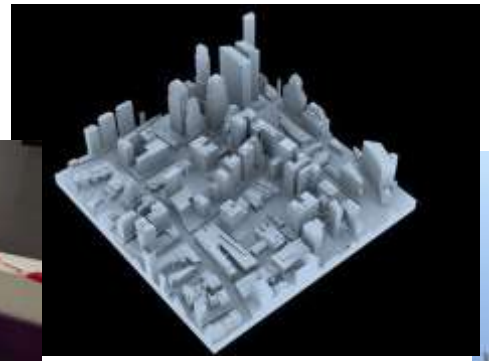

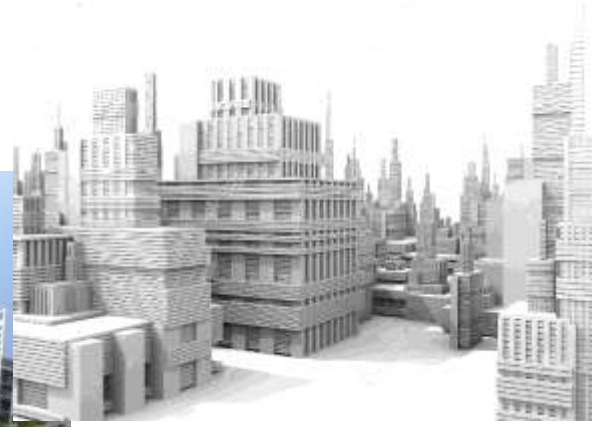

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■ 10 août 2017 à 11:00 UTC+2

Nobody Knows What Lies Beneath New York City

Subterranean cartographers are bringing to light the dark, tangled truths buried under the streets.

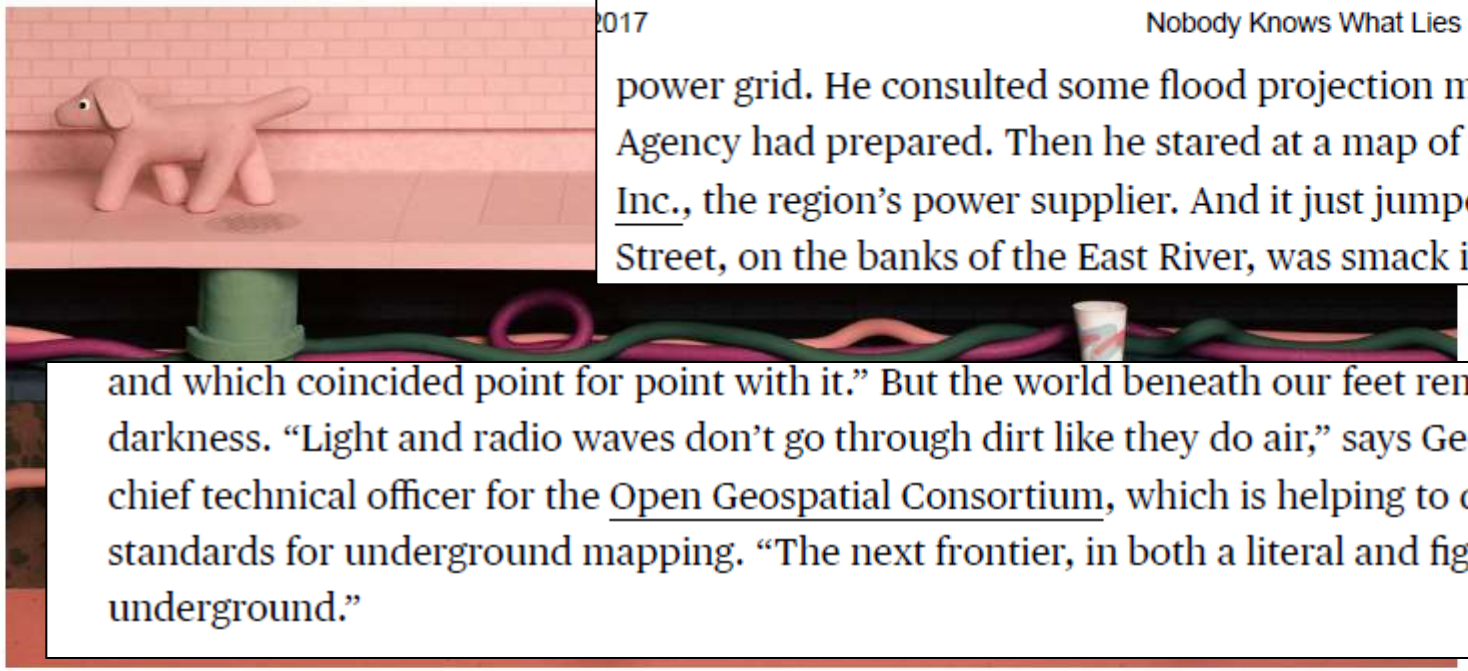

ILLUSTRATION: HUDSON CHRISTIE

By Greg Milner

power grid. He consulted some flood projection maps the Federal Emergency Management Agency had prepared. Then he stared at a map of the grid maintained by Consolidated Edison Inc., the region's power supplier. And it just jumped out at him: The substation at East 13th Street, on the banks of the East River, was smack in the middle of a flood zone.

and which coincided point for point with it." But the world beneath our feet remains shrouded in darkness. "Light and radio waves don't go through dirt like they do air," says George Percivall, chief technical officer for the Open Geospatial Consortium, which is helping to develop global standards for underground mapping. "The next frontier, in both a literal and figurative sense, is underground."

sign of how dangerous it is to miscalculate and rupture a gas line. Still, mistakes are common and inevitable. Strikes on underground infrastructure cost the city an estimated $300 million every year.

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Key challenges for smart / sustainable / resilient cities and infrastructures dependent of subsurface knowledge

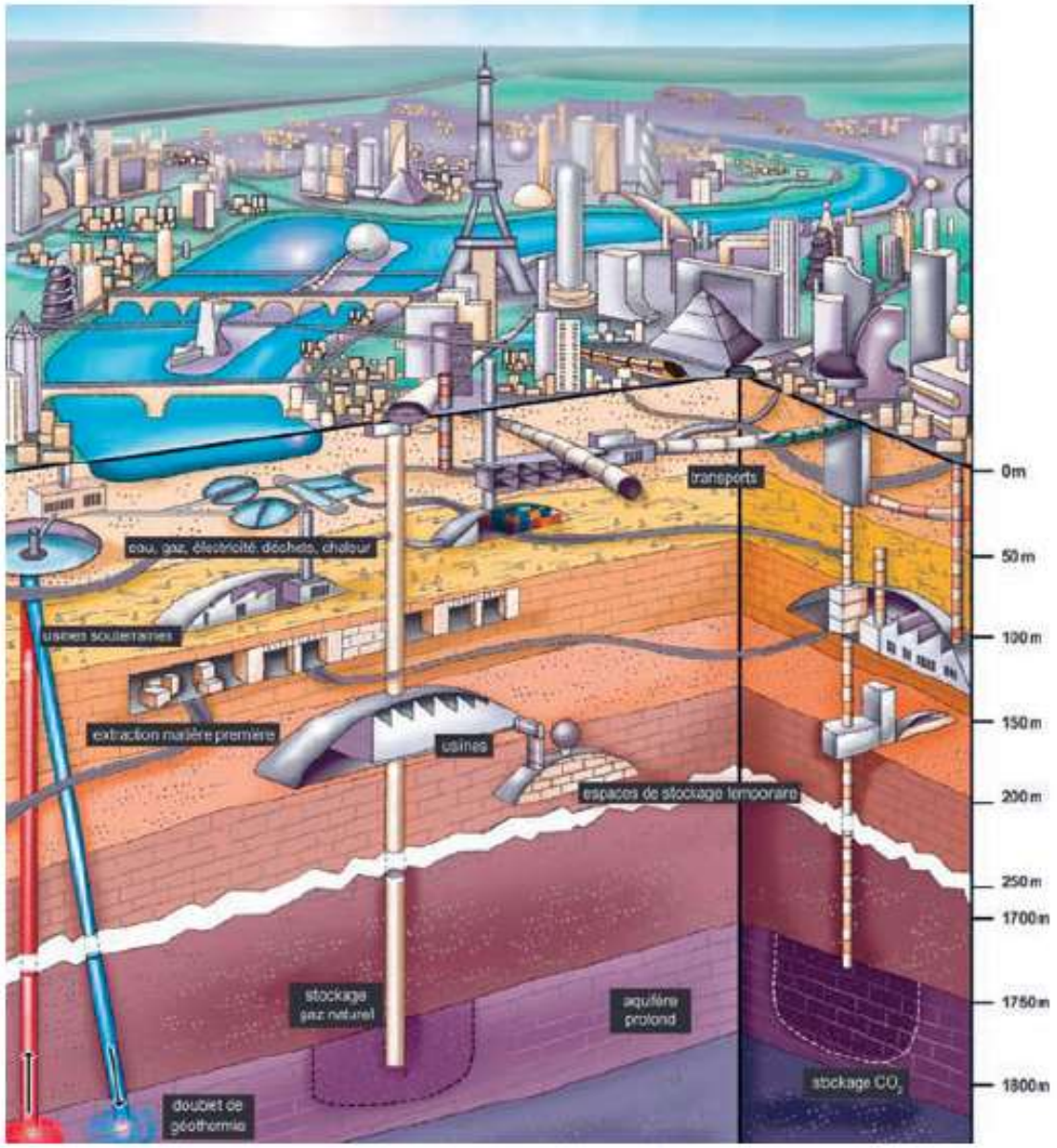
- **Geo-Hazards** : ground stability, subsidence, earthquake, flooding
- **Resources / services** : water, geothermal energy, energy storage, building materials
- Remediation of polluted soils, urban wastelands

…

- ***In the context of climate change and energy transition***
- ***and of increasing conflict of usage of the underground***

→ *We need an holistic modelling of cities that integrates the subsurface (and the other components of the natural environment as air, water, biodiversity)*

→ *Geological surveys, environmental agencies are information providers and data custodians*



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Why is it difficult to merge modelling of built environment and “geology” ?

	Built environment	“Geology”
Modelling process	Complete design by human	Progressive exploration, and understanding (increasing complexity)
Data acquisition	Relatively cheap (Lidar…)	Expensive and ”indirect”
Modelling tools	CAD engineering software	“geomodellers” (interpolation algorithms)
Standards	BIM CityGML	For 2d : GeoSciML Not for 3D (still software dependent)
Accuracy / uncertainty	Usualy well known (design – construction)	Difficult to estimate, communicate, and represent
Visualisation	VR tools for general public	“for experts only”
People	Engineers	Natural scientists

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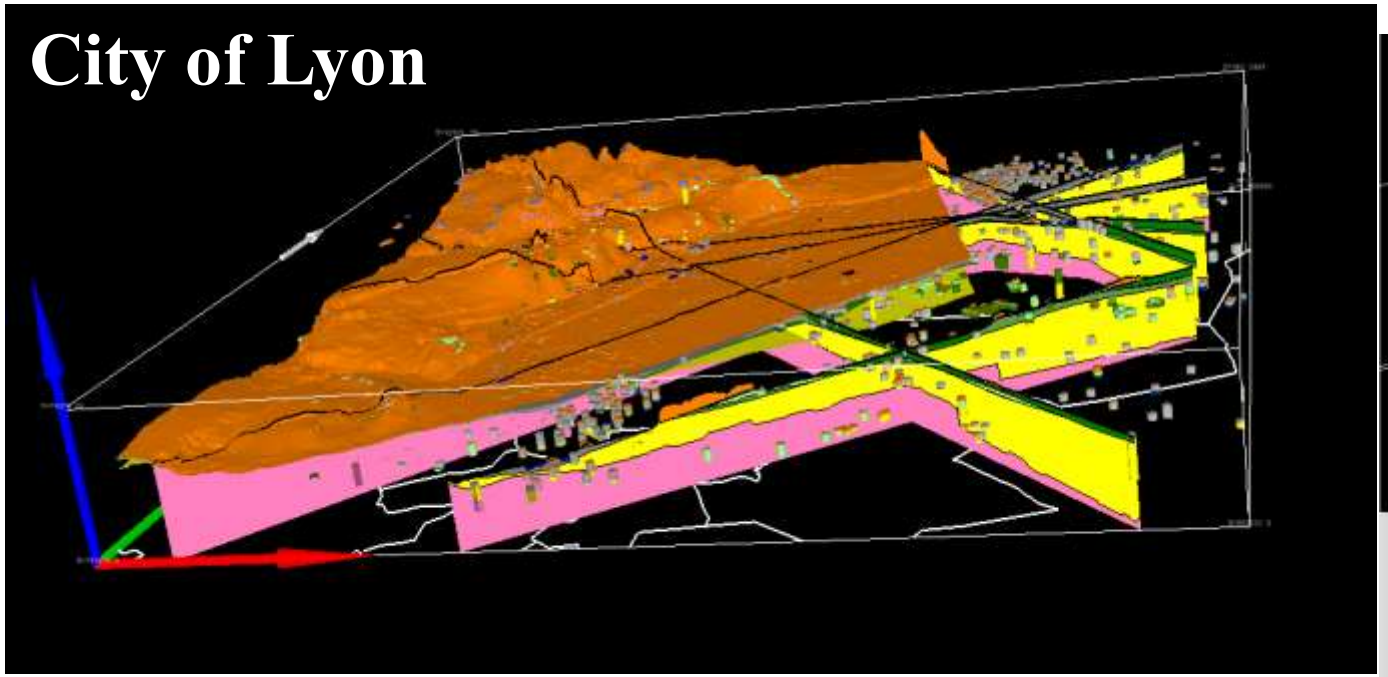
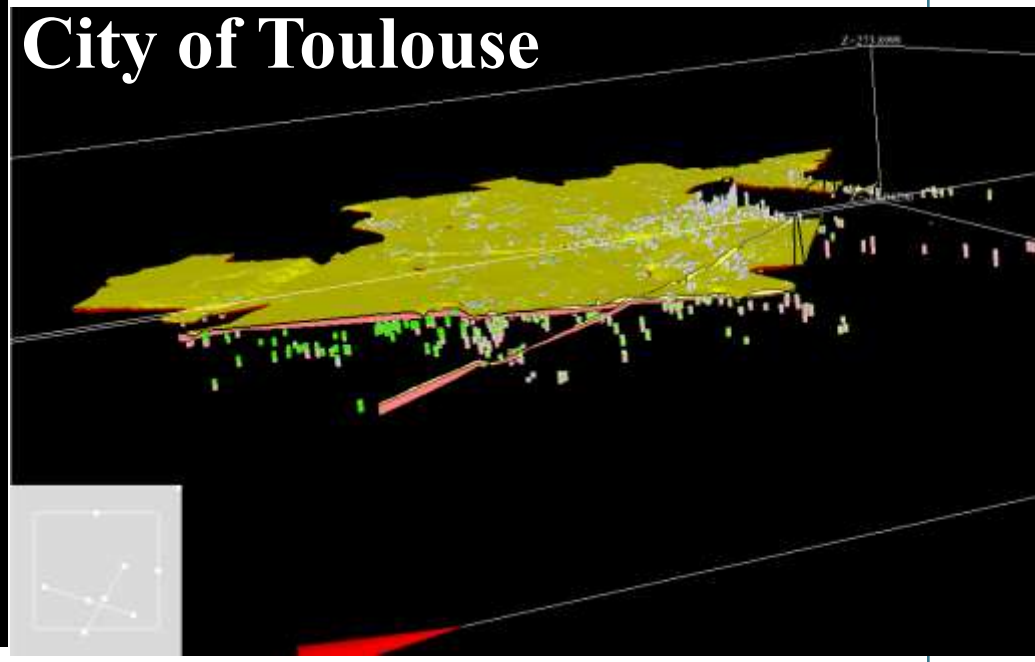
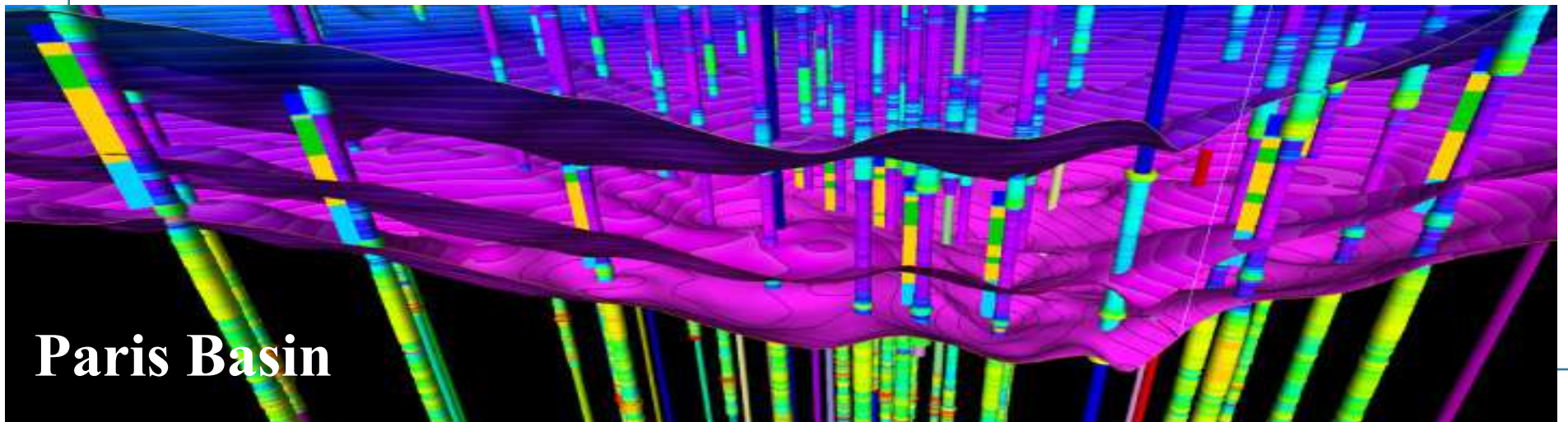
However, there are already examples / experiments …







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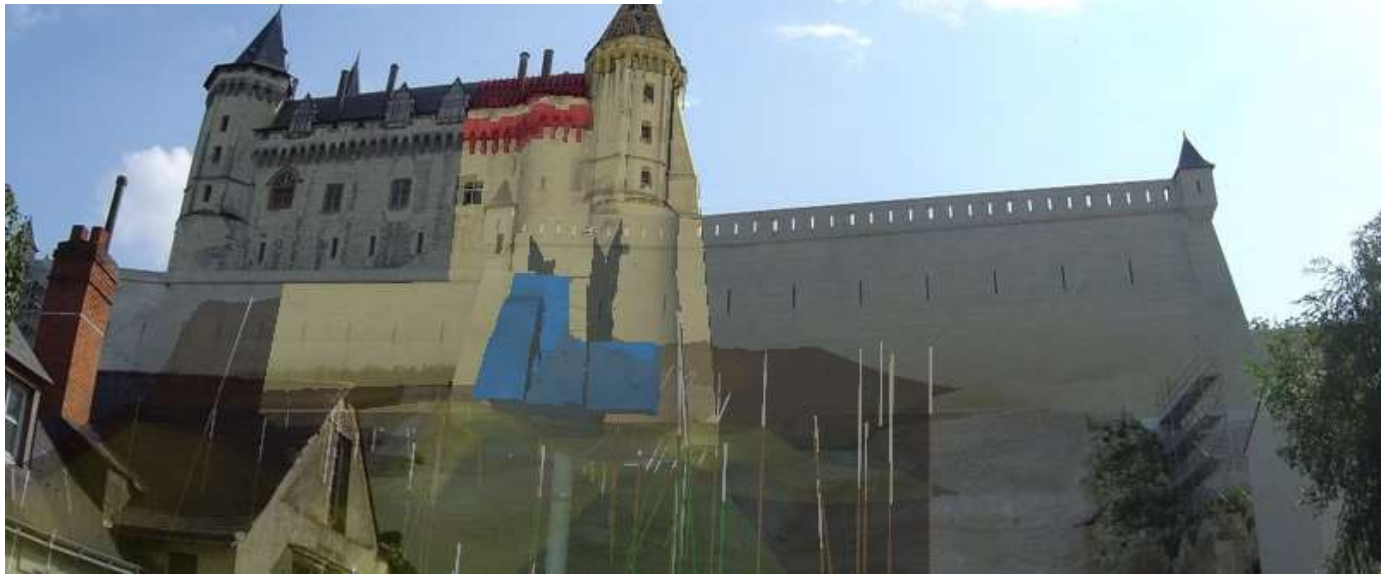
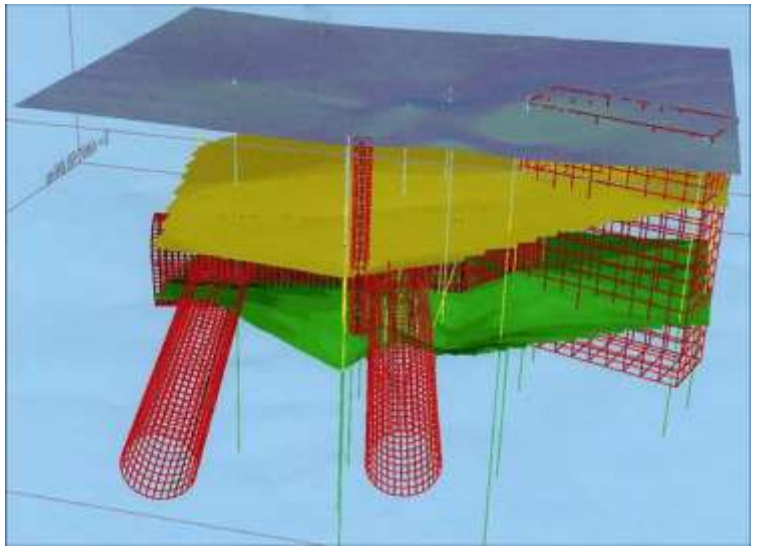
However, there are already examples / experiments …

RAXENV

2006-2008





DeepCity3D

2009-2012

> **But without shared best practices, common standards and real "integration" in current urban models**

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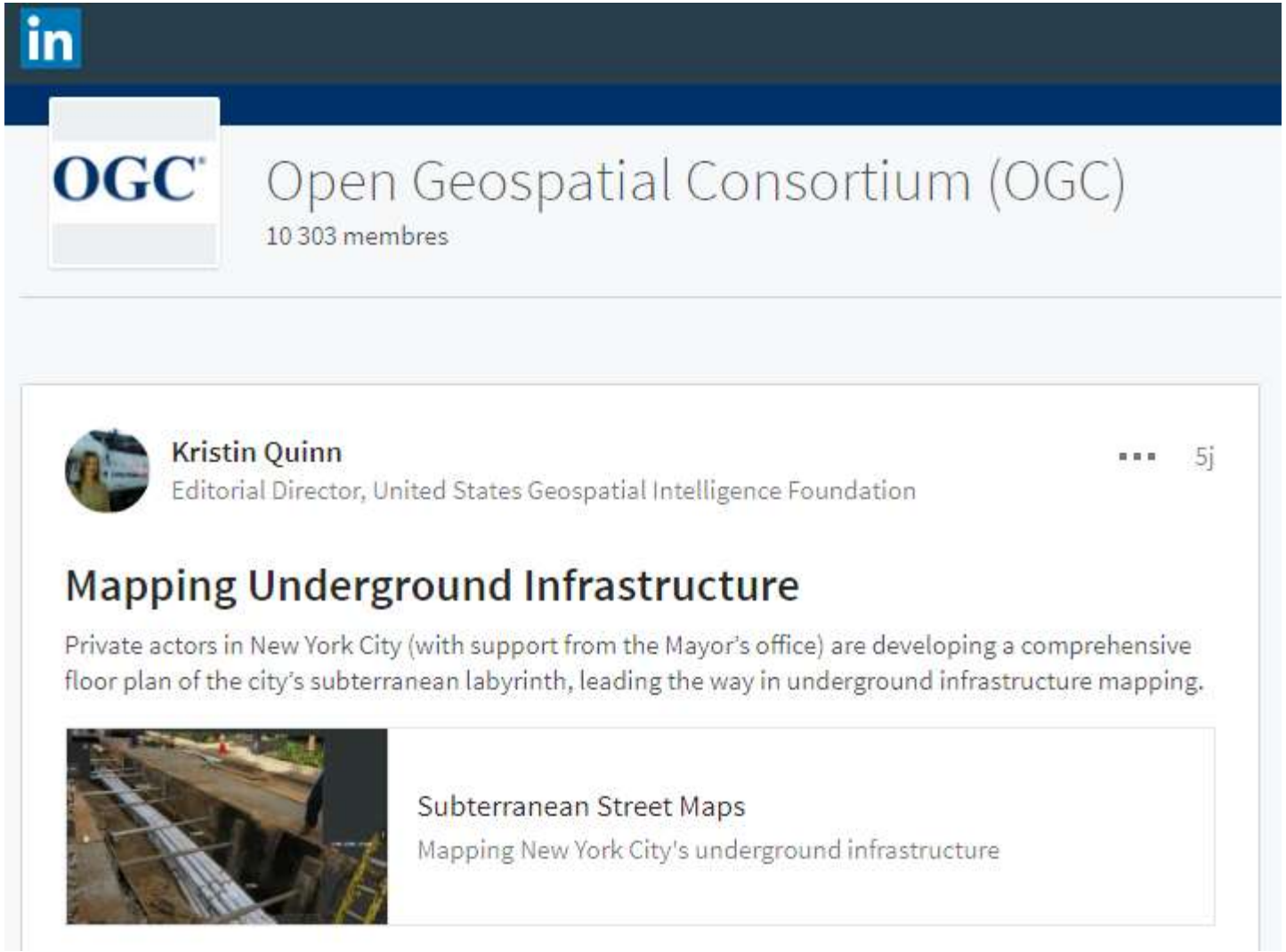
We must address the needs of smart cities and large infrastructures

- Deliver data / information / products for shallow subsurface
- In partnership with municipalities / engineering and utilities companies / …
- Through agreed (new) standards
  - for 3D geology (new OGC group !)
  - “interoperable” with BIM standards (Building Information Modelling)

- **Which makes possible the integration of “geology” with city models**

Recent initiatives



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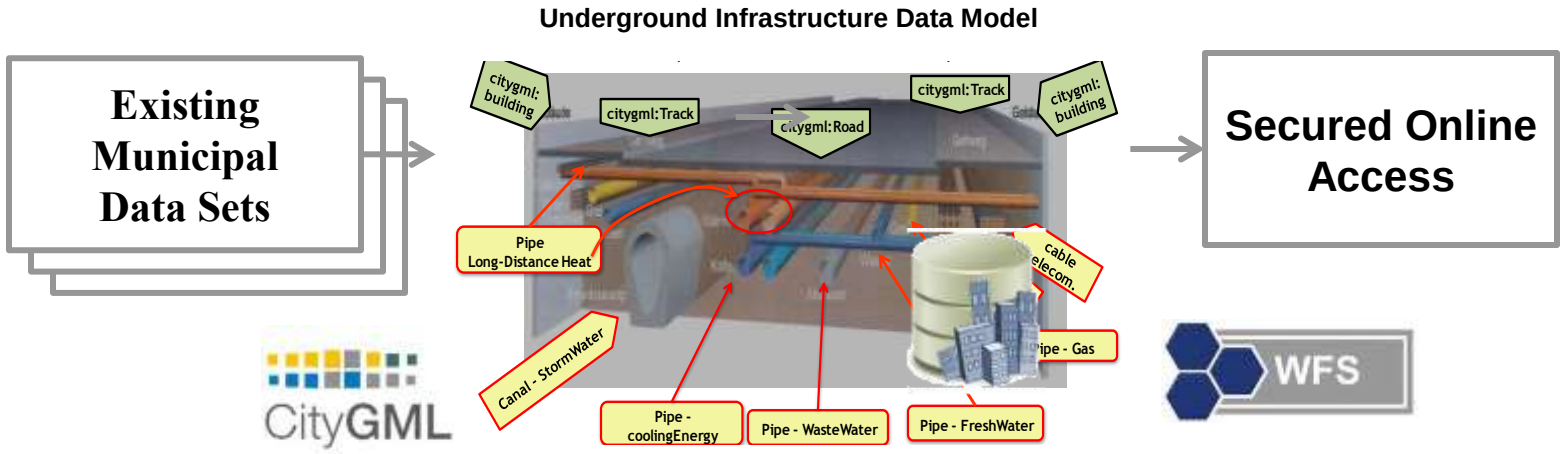
Proposed Underground Infrastructure Pilot

presented to NYC Mayor's office, May 2016

> **3D integration of underground critical infrastructure with secure online services for multiple applications**

- Routine operations, emergency response with cascading failures, withstand cyber attacks
- Foster coordination of local, state, federal governments and utilities

> **Suitable to any urban environment, e.g., New York City**



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MINnD http://www.minnd.fr/en/

- Interoperable Information Model for Sustainable Infrastructures
- A French consortium of 60 partners
- 1 goal : enhancing BIM capabilities for infrastructure modeling and management (complete lifecycle of infrastructures)

Modélisation des INformations INteropérables pour les INfrastructures Durables

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MINnD Underground Infrastructure

- Specific use case : standardizing underground infrastructure description process

- One main sponsor (French nuclear waste agency)
  - Importance of building and environment relationship

- Two main topics and working groups
  - Built environment (tunnels…) description
  - Relationship with its natural environment

- Objectives
  - Contribute to standardisation activity in OGC + BSI

ANDRA
French national radioactive waste management agency

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Final remarks

- We must not ignore the hidden / unknown part of reality in our « reality mesh » that is our natural environment
- Requires cooperation between actors from different skills, disciplines, organisations

→ standards are key for developing this interoperability

→ this is the right timing to engage !

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THANK YOU FOR YOUR ATTENTION

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